

# Letters to the Editor

## To the editor:

Katzmarzyk and Ardern<sup>1</sup> estimated the fraction of premature deaths in the Canadian population that were attributable to overweight and obesity by using relative risks from the 1981 Canada Fitness Survey that were adjusted for gender, age, smoking status and alcohol consumption. They then combined these relative risks with estimates of the prevalence of overweight and obesity in Canada from six Canadian surveys to calculate a population attributable risk (PAR) for each survey.

The formula the authors used for the calculation of the population attributable risk,  $PAR = \sum P(RR-1)/RR$ , includes the quantity  $P$  which the authors described as the population prevalence of overweight or obesity class. However, to calculate the attributable fraction correctly from an adjusted relative risk,  $P$  in this formula should be the prevalence of a given overweight or obesity class among decedents only, rather than the population prevalence of that overweight or obesity class.<sup>2,3</sup> The formula they give corresponds to formula 5 in Table 1 of reference 2 below, where it is stated that  $P$  is the proportion of cases (deaths in this example) falling into the  $i$ -th exposure level. Data on the prevalence of overweight and obesity among decedents (data which are often not available) would be needed to make appropriate estimates of the fraction of deaths attributable to overweight and obesity when using relative risks that are adjusted for confounding factors. Further, according to Benichou,<sup>3</sup> even this approach, which rests on the assumption of no interaction between obesity and the adjustment factors, could be misleading if interaction between obesity and adjustment factors is present.

The expected prevalence of overweight and obesity among persons who have died cannot be calculated directly from the prevalence of overweight and obesity in the general population, because the distribution of confounding factors will affect the prevalence of overweight and obesity among persons who died. Estimates of the population-attributable fraction that are calculated on the basis of adjusted relative risks and the prevalence of overweight and obesity in the general population without

taking into account the distribution of confounding factors could be biased.

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## REFERENCES

1. Katzmarzyk PT, Ardern CI. Overweight and obesity mortality trends in Canada, 1985-2000. *Can J Public Health* 2004;95(1):16-20.
2. Rockhill B, Newman B, Weinberg C. Use and misuse of population attributable fractions. *Am J Public Health* 1998;88:15-19.
3. Benichou J. A review of adjusted estimators of attributable risk. *Stat Methods Med Res* 2001;10:195-216.

## Response to Flegal, Williamson and Graubard:

We appreciate the comments of Flegal, Williamson and Graubard regarding our recent publication in the *Canadian Journal of Public Health*.<sup>1</sup> They raise important issues regarding the use of population attributable risk (PAR) and the potential bias that can result when calculations are based on adjusted relative risks and population prevalences of overweight and obesity. The equation employed in our study ( $PAR = \sum [(P(RR-1)/RR)]$ ) does indeed require that the prevalence ( $P$ ) be among cases (decedents in this case) rather than from the general population.<sup>2</sup> Unfortunately, in order to document temporal trends in mortality attributable to overweight and obesity, we had to link the adjusted relative risks (RR) obtained in a single Canadian study of overweight and obesity and mortality<sup>3</sup> with prevalences obtained from several representative population surveys. We realize that using this approach resulted in conservative estimates of the effects of overweight and obesity on mortality.

Flegal, Williamson and Graubard are correct in that data on the prevalence of over-

weight and obesity are rarely available for decedents, and indeed we had to rely on population estimates of overweight and obesity to document the temporal trends. Given that we modeled changes in overweight and obesity mortality on population survey data, we estimate here the effects of this approach using data from the original mortality study, which also used a representative sample (1981 Canada Fitness Survey).<sup>3</sup> The prevalences of overweight, obese class I and obese class II-III in the total sample at baseline were 30.6%, 7.2%, and 1.8%, respectively, resulting in a PAR of 6.8%. The prevalences of overweight, obese class I and obese class II-III in the decedents at baseline were 42.2%, 12.5%, and 2.9%, respectively, resulting in a PAR of 10.2%. As expected, the PAR calculated using general population prevalences of overweight and obesity was lower (by 33%) than that calculated from prevalences among the decedents only.

In conclusion, we used a conservative approach in our study to provide realistic estimates of the number of deaths attributable to overweight and obesity; however, the actual number of deaths attributable to excess body weight is likely higher than reported. This bias would have had little or no impact on the temporal trends or geographic variation described in the paper, as the analytical approach was applied consistently across all surveys. In general, PAR is used to provide theoretical estimates of the impact of risk factors on population health, and its use involves many assumptions. The theory behind PAR has advanced considerably in recent years<sup>4</sup>; however, there is still widespread confusion about its proper use and interpretation.<sup>2</sup> We hope this exchange has provided meaningful insights into some of the issues surrounding the use of PAR.

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3. Katzmarzyk PT, Craig CI, Bouchard C. Underweight, overweight and obesity: Relationships with mortality in the 13-year follow-up of the Canada Fitness Survey. *J Clin Epidemiol* 2001;54:916-20.
4. Benichou J. A review of adjusted estimators of attributable risk. *Stat Methods Med Res* 2001;10:195-216.